

Transforming Society through Sustainable Digital Economy

MYSEC 2018

Malaysian Software Engineering Conference 2018

PROGRAMME BOOK AND ABSTRACTS

7 - 9 August 2018
The Waterfront Hotel
Kuching, Sarawak



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**FOREWORD BY
YANG AMAT BERTAMAT
CHIEF MINISTER OF SARAWAK**

Assalamualaikum WBT and Salam Sejahtera.

Allow me take this opportunity to congratulate UNIMAS in collaboration with Malaysian Software Engineering Interest Group, which was established in 2005, on its successful hosting of the 11th Malaysian Software Engineering Conference (MySEC). We are proud with the continuous presence of MySEC in the state and nation as one of the leading Software Engineering conferences.



The theme “Transforming Society through Sustainable Digital Economy” reflects the relevance of the conference in addressing the rapid growth of Digital Technology in today’s world. We have seen how the software has seamlessly integrated itself into our daily activities. Today, the waves of technological feats are being pushed further in dealing with the complex process and huge amount of data which require powerful, high speed digital processor and reliable and efficient software.

This conference is held in line with Sarawak Digital Economy Strategy 2018-2022 in which we set out to enable Sarawak to shift towards digital economy in order to position itself at the forefront of the digital world. Digital economy is not merely about digital technology, but how the society can be organized and derived benefits from it in a cost-effective manner. Going ‘digital’ is now a global trend, and in the near future digital technology may become an essential requirement to our everyday lives. In order to achieve this, we need diverse talents in a number of key focus areas, such as digital infrastructure, cyber-security, talent development, e-commerce, R&D in digital technology, digital innovation entrepreneurship and digital government.

The anchor sectors of Sarawak Digital Economy are Agriculture, Manufacturing-Industry 4.0, Tourism, Smart City, Digital Health, e-Commerce and Digital Government. Hence, to ensure a continuous development of Sarawak Digital Economy, the Sarawak Government has set up the Sarawak Multimedia Authority (SMA), led by me as the Chairman, and assisted by a Board of Directors.

Also, innovation in software design is going through exciting times. Look at your tablet. Look at your mobile phone. Look at how easy it is to hold, read, and navigate these devices. These user-friendly features open up creative and purposeful usage in several sectors like education, where tablets are increasingly being adopted in classrooms; healthcare, where doctors are now making

their rounds in hospital wards while still be able to access patients records at the touch of a button; retail, where sales teams on roadshows or at exhibition booths are able to highlight their products on tablets interactively, and immediately enabling them to convince potential buyers.

The direct and indirect impact of this technological change to our everyday lives must not be ignored. Instead of watching from the sidelines, we must prepare ourselves by engaging in the change to shape the future of the nation. I believe that, in order to be an internationally competitive nation, we are part of the technology advancement, that reflects the identity and aspirations of the nation and then enhance it to the maximum capability for transforming huge amount of scientific, cultural and community data in the country into useful knowledge.

I hope this conference will be a platform for you to learn and work on innovative ideas for the future of our nation. There is a possibility of producing reliable and efficient software which may be run on lightweight and energy efficient devices. There is always a trade-off between complex software and huge data in lightweight device, but perhaps this is a challenge for us to think of how to optimize the integration reliably and seamlessly.

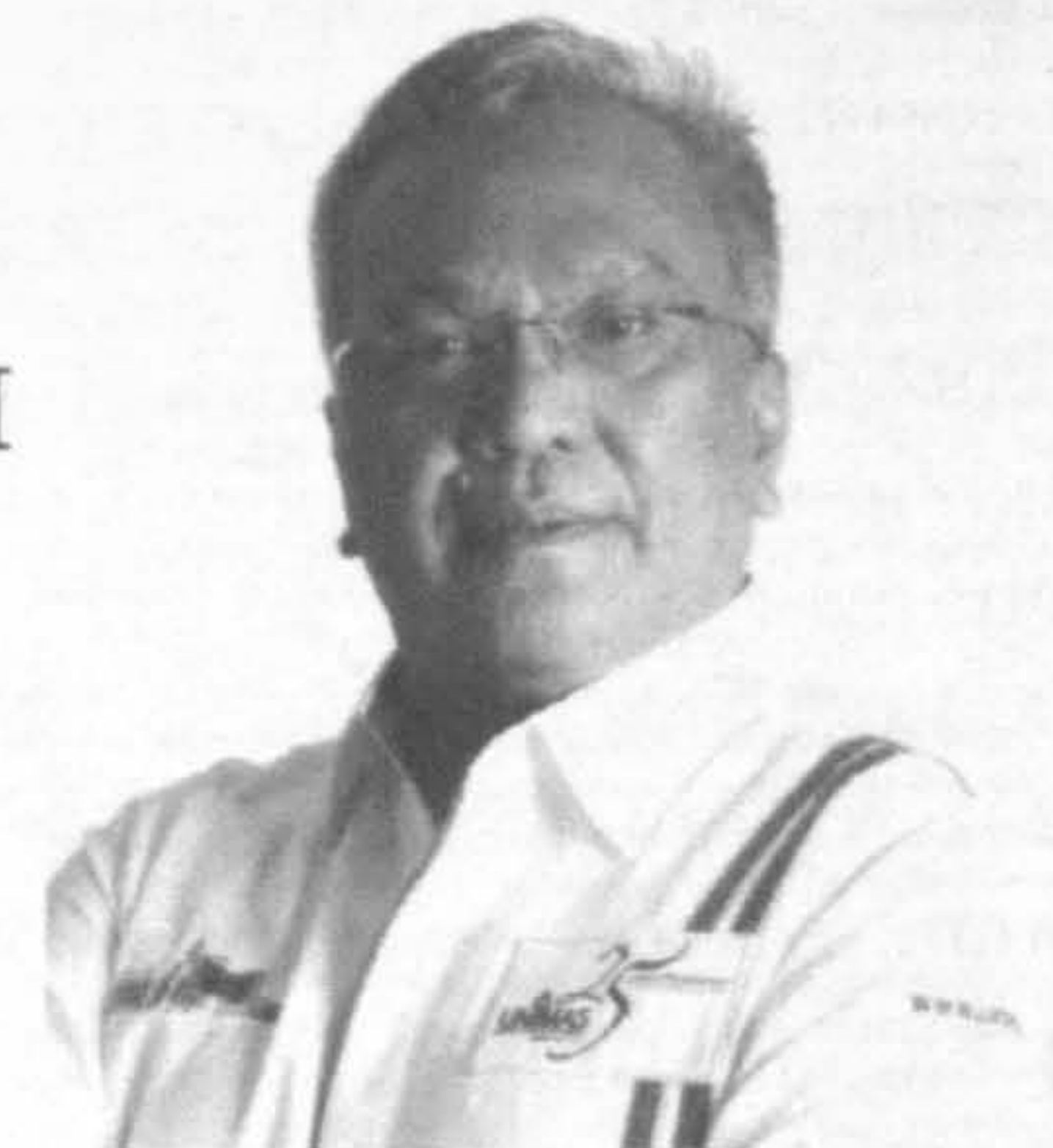
I am sure MySEC will continue to play an important role in strengthening research in ICT particularly in software engineering, and in turn spur continuous development and innovation not only in Sarawak, but throughout Malaysia as well.

Thank You



**DATUK PATINGGI (DR) ABANG HAJI ABDUL RAHMAN ZOHARI
BIN TUN DATUK ABANG HAJI OPENG**

**FOREWORD BY
VICE CHANCELLOR
UNIVERSITI MALAYSIA SARAWAK
YBHG PROF DATUK DR MOHAMAD KADIM SUAIDI**



Assalamualaikum WBT and Salam Sejahtera,
Salam UNIMASku sayang.

First and foremost, I would like to extend my warmest welcome to the 11th MALAYSIAN SOFTWARE ENGINEERING CONFERENCE 2018 (MySEC2018). Also, I would like to congratulate the Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak for organising this biennial flagship event.

Information and Communication Technology (ICT) is now part of our daily life. ICT is fundamentally altering the ways in which we communicate, act and decide. Current technologies such as big data, autonomous car, robotics and AI applications have evidently supporting human lives in unimaginable ways. This year's conference theme: "Transforming Society through Sustainable Digital Economy", points to the current focus in the science of Information Technology. This conference is a venue for academics, researchers and industries to present recent findings and development related to Software Engineering and ICT perspectives across the sciences, engineering, arts and humanities. We believe that the sharing by the speakers and presenters will give a deeper insight into the influence of software engineering as a discipline to shape the Sarawak Digital Economy Strategy 2018-2022.

In order to stay relevant to the needs of the industry, the Faculty of Computer Science and Information Technology, UNIMAS is actively collaborating with several industry partners, such as SAINS and SACOFA, to ensure that the curriculum offered at the university will be progressively aligned with the needs of the industry. Due of these efforts, the graduate employability for graduates of the Computer Science and IT in UNIMAS is recorded at 87% in 2017. This is a proof that our students are taught and trained sufficiently to fit the industry's needs.

I am convinced that UNIMAS will continue to play an important role in strengthening education and research in ICT and Sarawak Digital Economy for many years to come not only for the state of Sarawak, but Malaysia as well.

Thank you.

**FOREWORD BY
DEAN
FACULTY OF COMPUTER SCIENCE
AND INFORMATION TECHNOLOGY, UNIMAS
ASSOCIATE PROFESSOR DR JOHARI ABDULLAH**



Assalamualaikum w.b.t, and greetings,

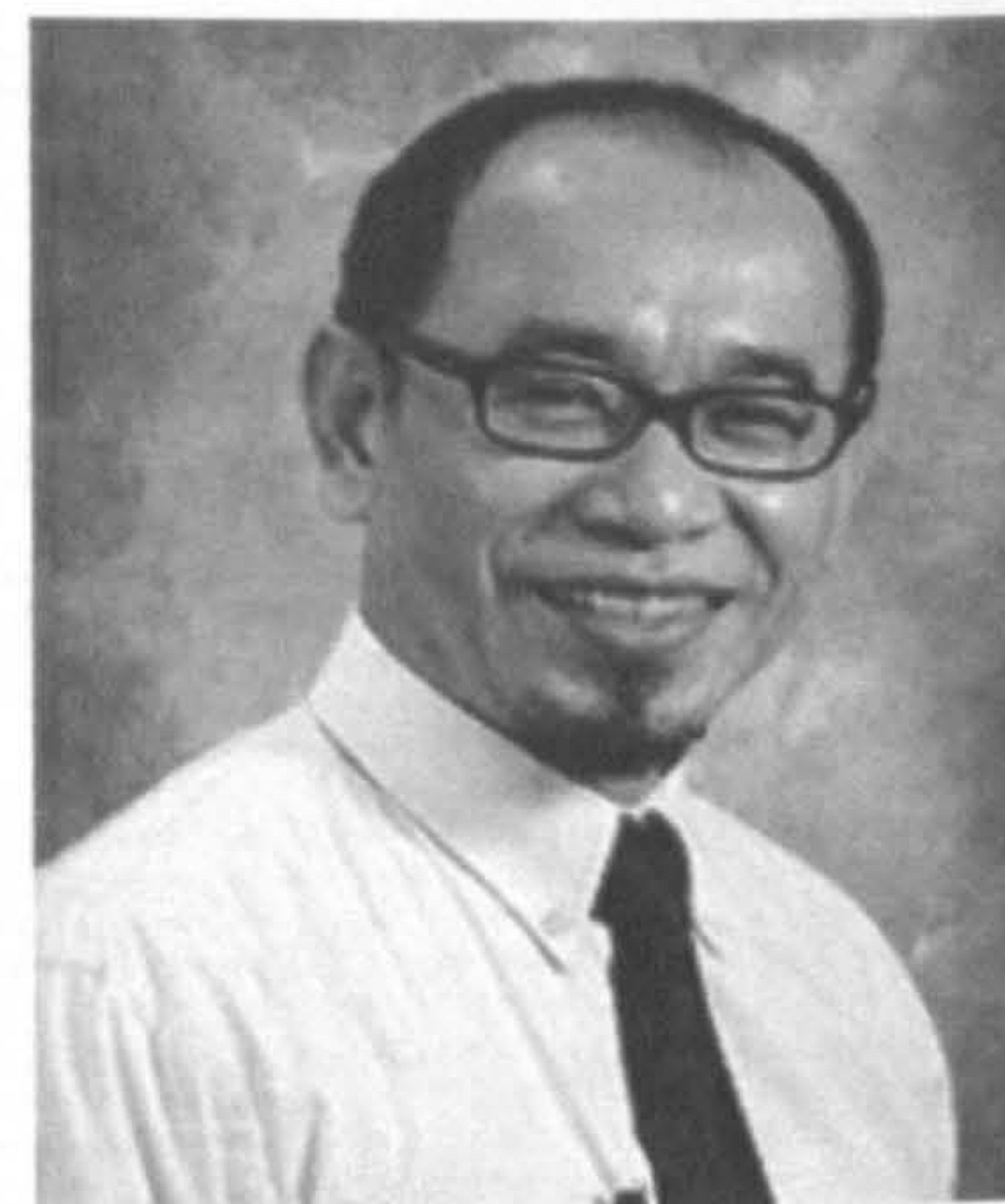
On behalf of the faculty and UNIMAS, I would like to extend a warm welcome to all the participants of the 11th Malaysian Software Engineering Conference (MySEC2018) which is held in the beautiful city of Kuching, Sarawak from 7th to 9th August 2018. The Faculty of Computer Science and IT, UNIMAS is proud to organize this conference in collaboration with the Malaysian Software Engineering Interest Group (MySEIG).

With the advancement and challenges poses by the 4th Industrial Revolution to our society in general, and to all of us as academicians, MySEC2018 will be a great platform for practitioners and researchers from academia, industry and government sectors to share and discuss areas related to Software Engineering and other areas of Computer Science in general. The theme selected for this conference, “Transforming Society through Sustainable Digital Economy”, reflects the importance of Digital Economy throughout the world. Specifically, the initiative taken by the Sarawak State Government, whom have embarked upon the Digital Economy initiative last year in April 2017 for transforming the economy of the state from depending on the natural resources and agriculture to an economy which is based on technology and knowledge.

I would like to record my sincere appreciation to each and every one whom has contributed in ensuring the success to this event. We hope that everyone will have an exciting and memorable moment throughout MySEC2018.

Thank you.

**WELCOMING MESSAGE BY
MySEC2018 CHAIR
ASSOCIATE PROFESSOR DR EDWIN MIT**



The Organizing Committee warmly welcomes our distinguished delegates and guests to the 11th Malaysian Software Engineering Conference (MySEC), held on 8-9 August 2018 in Kuching, Sarawak. MySEC2018 is organized by UNIMAS Faculty of Computer Science and Information Technology, in collaboration with Malaysian Software Engineering Interest Group (MySEIG).

The theme of the conference, “Transforming Society through Sustainable Digital Economy” reflects the relevance of the conference in addressing the rapid growth of ICT in this era. ICT technology today is capable in manipulating huge and complex data, which helps us in providing meaningful and beneficial impact to the society within the socio-economic perspective.

I would like to thank, our keynote and invited speakers, for their support to our conference. My heartiest thanks to Prof Dr Ali Selamat (UTM, Malaysia), Associate Professor Dr Sim Yee Wai (University College of Technology Sarawak), Professor Dr. Shamsul Sahibuddin (UTM, Malaysia), Mr. Ahmad Nazri bin Mohd Jamil (IBM Malaysia Sdn Bhd), Associate Professor Dr Jaap Gordin (Vrije Universiteit, Amsterdam, Netherlands) for their time and willingness to share their experience and knowledge. Also a big thank you to the panel of reviewers and the programme committee for the excellent job done.

I am deeply indebted to the members of the organizing committee for the excellent team spirit and teamwork. I record my sincere appreciation to each and everyone who has contributed in ensuring the success to this event.

We extend our sincere appreciation to all sponsors for their generous contributions, namely Sarawak Energy Berhad (SEB), Sarawak Land Consolidation & Rehabilitation Authority (SALCRA), Sarawak Convention Bureau (SCB), SACOFA Sdn Bhd, Mira Cake House, ARIVA Serviced Residences Kuching and Dewan Bandaraya Kuching Utara (DBKU).

I also take this opportunity to apologize for all the shortcomings in the organization of the event. We wish you all an enjoyable conference with fruitful deliberations and bid a warm Selamat Datang to the Land of Hornbills.

Thank you.

MySEC2018 Conference Schedule

Day 1 : Tuesday, 7th August 2018 : Sarawak River Cruise

Day 2: Wednesday, 8th August 2018

Time	Agenda			
0800-0900	Registration			
0900-1100	Opening Ceremony Welcoming Speech by Vice-Chancellor of Universiti Malaysia Sarawak, Professor Datuk Dr. Mohamad Kadim bin Suaidi Speech by Chief Minister of Sarawak, YAB Datuk Patinggi (Dr) Abang Haji Abdul Rahman Zohari bin Tun Datuk Abang Haji Openg <i>Venue: Tubau 1, 2, 3</i>			
1100-1115	Tea Break			
1115-1215	Keynote Address 1: Usability Prioritization Using Performance Metrics and Hierarchical Agglomerative Clustering in Mobile Augmented Reality Learning Application Speaker : Prof. Dr. Ali Selamat , Universiti Teknologi Malaysia Chairperson : Prof. Dr. Narayanan Kulathuramaiyer <i>Venue: Tubau 1, 2, 3</i>			
1215-1315	Invited Speaker 1: Software Quality vis-à-vis DevOps Speaker : Prof. Dr. Shamsul Sahibuddin , MySEIG Chair, Universiti Teknologi Malaysia Chairperson: Assoc. Prof. Dr. Johari Abdullah <i>Venue: Tubau 1, 2, 3</i>			
1315-1415	Lunch Break			
1415-1515	Keynote Address 2: Drones in Agriculture Applications Speaker : Assoc. Prof. Dr. Sim Yee Wai, University College of Technology Sarawak Chairperson: Assoc. Prof. Dr. Jane Labadin <i>Venue: Tubau 1, 2, 3</i>			
1515-1655	Session 1A <i>Software Process and Measurement</i> <i>Venue: Tubau 1</i>	Session 1B <i>Software Approach</i> <i>Venue: Tubau 2</i>	Session 1C <i>Application for Priority Sectors</i> <i>Venue: Tubau 3</i>	Session 1D <i>Software Tools and Environment & Application for Priority Sectors</i> <i>Venue: Kerangas</i>
1655-1725	Tea Break			
1945-2230	Conference Dinner <i>Venue: Tubau 1, 2, 3</i>			

MySEC2018 Conference Schedule

Day 3: Thursday, 9th August 2018

Time	Agenda			
0830-1030	Session 2A <i>Software Process and Measurement</i> Venue: Tubau 1	Session 2B <i>Software Approach</i> Venue: Tubau 2	Session 2C <i>Application for Priority Sectors</i> Venue: Tubau 3	Session 2D <i>Software Process and Measurement</i> Venue: Kerangas
1030-1100	Tea Break			
1100-1200	Invited Speaker 2: <i>Enablers of Success in Digital Economy</i> Speaker : Mr. Ahmad Nazri bin Mohd Jamil, IBM Malaysia Sdn Bhd Chairperson: Prof. Dr. Wang Yin Chai Venue: Kerangas			
1200-1300	Invited Speaker 3: <i>Requirements Engineering for Digital Innovation</i> Speaker : Assoc. Prof. Dr. Jaap Gordijn , Vrije Universiteit Amsterdam Chairperson: Dr. Dayang NurFatimah Awang Iskandar Venue: Kerangas			
1300-1400	Lunch Break			
1400-1540	Session 3A <i>Software Process and Measurement & Software Tools and Environment</i> Venue: Tubau 1	Session 3B <i>Software Approach</i> Venue: Tubau 2	Session 3C <i>Application for Priority Sectors</i> Venue: Tubau 3	Session 3D <i>Software Approach</i> Venue: Kerangas
1540-1630	Closing Ceremony Closing Speech by Conference Chair, Assoc. Prof. Dr. Edwin Mit Venue : Kerangas			
1630-1700	Tea Break			

KEYNOTE 1
PROF. DR. ALI SELAMAT
UNIVERSITI TEKNOLOGI MALAYSIA



Ali Selamat is currently the Dean for Malaysia-Japan International Institute of Technology (MJIIT). He was a Chief Information Officer (CIO) and Director of Computer and Information Technology, Universiti Teknologi Malaysia (UTM), the Dean of Research, Knowledge Economy Research Alliance, UTM. He is currently a Chair of IEEE Computer Society Malaysia Chapter. He is also the Editorial Boards of Knowledge Based Systems – Elsevier, International Journal of Information and Database Systems (IJIIDS), Inderscience Publications, Vietnam Journal of Computer Science, Springer Publications. He is the Program Co-chairs of International Conference on Software Engineering Tools, Methodologies (SOMET), 2018 to be held in Granada, Spain in September 2018. He has been a visiting professor at Hradec-Kralove University, Czech Republic, Kuwait University, and few other universities in Japan. His research interests include cloud based software engineering, software agents, information retrievals, pattern recognitions, genetic algorithms, neural networks and soft-computing, knowledge management, key performance indicators.

USABILITY PRIORITIZATION USING PERFORMANCE METRICS AND HIERARCHICAL AGGLOMERATIVE CLUSTERING IN MOBILE AUGMENTED REALITY LEARNING APPLICATION

This research highlights the current literatures in usability studies, performance metrics and machine learning algorithm. A literature review is done in these three areas of studies to find a research gap that can be explored further. We propose a research methodology to attend to the issues of machine learning and usability. An experiment is proposed to compare the efficiency results in between data consistency, correlation between performance metrics and self-reported metrics of a Mobile Augmented Reality (MAR) learning application. The methodology proposes hierarchical agglomerative clustering technique as a solution in differentiating usability issues according to priority in order to help with usability re-engineering decisions. We propose two objectives through the proposed framework and present evidence on how to achieve them.

KEYNOTE 2
ASSOC. PROF. DR. SIM YEE WAI
UNIVERSITY COLLEGE OF TECHNOLOGY
SARAWAK

Associate Professor Dr Sim Yee Wai is currently serving at School of Computing, University College of Technology Sarawak, as the Head of Programme of Network Computing. Apart from that, he was also appointed as the Director of Drone Research and Application Center to overlook the operation and business of the center. His PhD, funded by University of Southampton at United Kingdom, was in the area of expert finding system using machine learning technology. Since completion of his PhD, he has been working on a number of postdoctoral projects at United Kingdom which involved Rolls Royce, and Jaguar Land Rover, studying ways of optimizing design process to gain a competitive edge in terms of better business performance. He is also an active researcher and consultant in Unmanned Aerial Systems (UAS), particularly in the area of integration of drone technologies and artificial intelligence into business processes. In addition, he is a HRDF certified trainer who had conducted numerous training in the areas of drone operation and programming for students and companies.



DRONES IN AGRICULTURE APPLICATIONS

Drones, similar to the Internet, originated from the military to become powerful business tools today. With the rapid advancement of drone technology over the past decade, the agriculture industry is now at a turning point. Such advances have complemented the traditional technologies employed in agricultural applications, and enabled a more holistic approach to data collection. For example, drones can be used to replace satellites for remote surveillance purpose with images of higher resolution, and unobstructed by clouds. Furthermore, the different types of cameras fitted on drones can be used in applications such as land cover classification, tree counting, pest and disease detection, and yield estimation. Drones can also be used in crop dusting or spraying with more precision than a traditional tractor, which in turn help to reduce costs and potential pesticide exposure to farmers. There are estimates that 80% to 90% of the growth in the drone market in the next decade will come from agriculture. As the technology gets better and the cost continues to decrease, drones will have a wider application in the future for the agriculture industry.

INVITED 1
PROF. DR. SHAMSUL SAHIBUDDIN ,
MYSEIG CHAIR



SOFTWARE QUALITY VIS-A-VIS DEVOPS

Software quality has been the focus of software engineering research works since the beginning of software development. The ultimate aims were to satisfy the needs of the users or customers requirement. Much work has been done in the areas of software quality characteristics, models, frameworks and processes. The software engineering lifecycles and methods shapes the development and formulation of software quality works. The traditional waterfall lifecycles and the sequential nature of development and operations influences the concepts and processes in software quality.

Works on DevOps started in 2009, with the bulks of it started to appear in the last five years. Most of works on DevOps is on how to bridge the gap between development and operations. DevOps itself has also been coined in other ways, such as a communication and collaboration paradigm between development and operations. Automation of software quality assurance is also another key aspect to success of DevOps. Another angle of works on DevOps is from the Agile, Continuous Integration and Continuous Delivery perspective.

Quality Assurance has always been an integral part and parcel of DevOps. In this presentation, we will be discussing software quality in relations to DevOps. Fundamentals of Software Quality in the traditional sense will be discussed. Research works on the area of software quality model and process influenced by DevOps will be presented. There is also the issue of the touching point between development quality processes and operations.

INVITED 2
MR. AHMAD NAZRI BIN MOHD JAMIL
IBM MALAYSIA SDN BHD

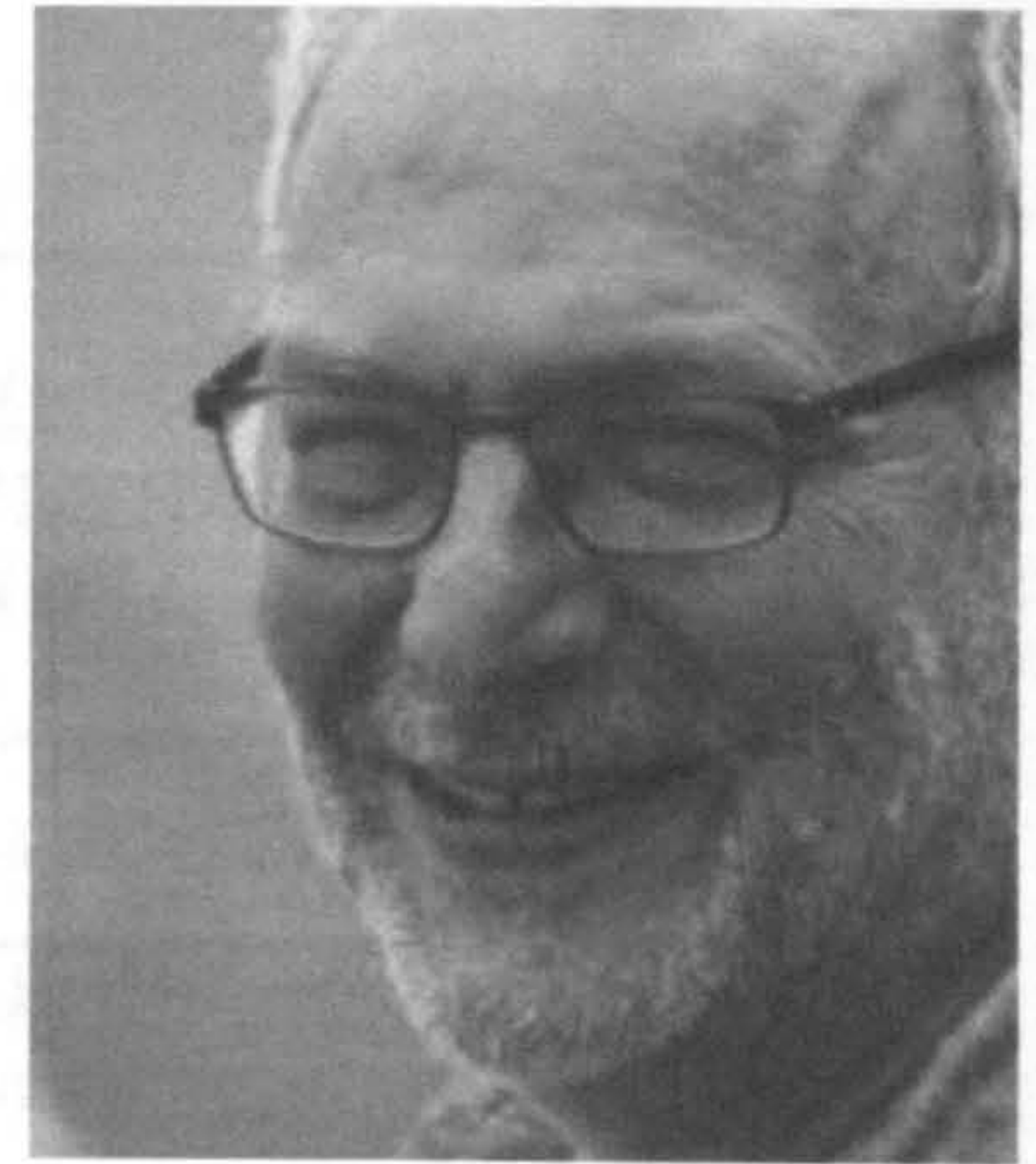


Mr. Ahmad Nazri bin Mohd Jamil is a well-versed Information Technology (IT) professional with more than 18 years of progressive experience. He is currently a Program Director and Netcool Integration Development & Malaysia Dev Lab Leader at IBM Malaysia Sdn Bhd. Besides having strong management skills, he is competent in software development/delivery with outstanding customer service skills and passion for continuous improvement. He received a Bachelor of Science in Computer Engineering at the University of Illinois at Urbana-Champaign, Illinois, USA and has hands-on industrial experience with multi-national companies serving global customers. Upon returning to Malaysia, he proves his ability to manage a team of highly technical individuals (senior managers, senior and junior engineers and developers) in technical support (1st and 2nd line support) and research and development (R&D) environment, serving world-wide customers. His has strong passion in driving improvement on Service Quality, business KPIs and cost reduction through systematic approach of continuous improvement in business process and practices that conform to various standards such as ITIL framework, Agile development methodology and Model Driven Engineering. He has also proven his ability to fulfill diverse roles in analytical research, UNIX scripting, programming, operations management, mission transfer, start-up, database development, technical support, support centers, service desk, project management and software consulting. His experiences and skills in Telecommunication and general businesses, especially pertaining to IP, performance and fault management and operations coupled with strong relationship with Telco operators, Banking and Utilities providers in the region are undeniably substantial for the field.

ENABLERS OF SUCCESS IN DIGITAL ECONOMY

A brief look at how individuals, commercials and academia can take advantage of the technology disruptors such as data, cloud and artificial intelligence to thrive in Digital Economy. Also a view at the methods in harnessing these new resources to create values in the new economy. Apart from exploiting technologies, we will also examine other factors such as soft skills in order to prepare and excel in Digital Economy using the lens of industry players.

INVITED 3
ASSOC. PROF. DR. JAAP GORDIJN
VRIJE UNIVERSITEIT AMSTERDAM



Assoc. Prof. Dr. Jaap Gordijn is the CEO of The Value Engineers, an EU company specializing into the development of new value propositions using innovative technologies such as blockchain. Jaap Gordijn is associate professor at the Vrije Universiteit Amsterdam, The Netherlands, Computer Science department. His research focusses on the design process of commercial electronic services (e.g. Netflix or Spotify). He published over 120 scientific papers at international conferences, workshops, and journals. In addition to his academic career, he also has extensive experience in industry. He has worked for Bakkenist Management Consultants, Deloitte & Touche, and the Internet Business Solution Group of Cisco Systems (IBSG). This group advises the Fortune 500 companies worldwide regarding their e-business strategy. Jaap holds a PhD degree from the Vrije Universiteit Amsterdam, Computer Science, a MSc/BSc degree in Information Science, University of Tilburg, Economics Faculty, and BSc degree in Technical Computer Science. During his consultancy practice, he acted as business developer, and advised many starting companies, but also multi-nationals, and specifically networks of enterprises. His current interest is in the digital content industry and Fintech. Jaap is advisor of Intellectual Music Property Societies in The Netherlands, and works with banks to develop innovative banking services based on blockchain technology.

REQUIREMENTS ENGINEERING FOR DIGITAL INNOVATION

In addition to the wave of Digital Transformation, which is the use of new technologies for existing services and processes, there is also the phenomena of Digital Innovation, using the same technologies for really new services. Examples include music- and video on-demand services, Google Home, and the Tesla products. These new services need to be properly and thoroughly understood, both from a commercial and IT perspective. In this talk, I present a requirements engineering technique called e3value, which has the rigor of IS methods, but the terminology of Marketing and Economics. It is the first step in a requirements engineering process, aimed to understand the parties involved, what they exchange of economic value with other, and to analyze the network of parties for economic sustainability. We will present a number cases from various disciplines, including the entertainment industry, telecommunication and ICT4D.

PARALLEL SESSION : 1A

TIME	<u>THEME</u> SOFTWARE PROCESS AND MEASUREMENT		Chair : Ts. Syahrul Nizam Junaini
	VENUE : TUBAU 1		8th AUGUST 2018
15:15	14	An Empirical Study on Functional Testing Process Model for Mobile Apps Testing: Towards Improving Legacy Mobile Apps Mastura Abu Kasim and Noor Hasrina Bakar	
15:35	36	Risk Factors for Software Requirements Change Implementation Marfizah Abdul Rahman, Rozilawati Razali and Fatin Filzahti Ismail	
15:55	84	An Experiment of Different Prioritization Algorithms on Test Case Prioritization Technique for Software Product Lines Muhammad Sahak, Dayang N. A. Jawawi and Shahliza Abd Halim	
16:15	85	Team Formation for Agile Software Development: A Review Dzulaiha Aryanee Putri Zainal, Rozilawati Razali and Zulkefli Mansor	

PARALLEL SESSION : 1B

TIME	THEME SOFTWARE APPROACH		Chair : Assoc. Prof Dr Edwin Mit
	VENUE : TUBAU 2		8th AUGUST 2018
15:15	10	Enhancing Prediction Method of Ionosphere for Space Weather Monitoring Using Machine Learning Approaches: A Review Nor'Asnilawati Salleh, Siti Sophiayati Yuhaniz, Sharizal Fadlie Sabri and Nurulhuda Firdaus Mohd Azmi	
15:35	25	A Study on Reuse-based Requirements Engineering by Utilizing Knowledge Pattern Sabrina Ahmad and Zariza Hashim	
15:55	30	Test Case Prioritization Approach for Sequence of Events using Complexity Factor Emyreema Ja'AFar, Saadah Hassan, Salmi Baharom and Johanna Ahmad	
16:15	42	Improved Feature Extraction Method with Statistical Based Time Frequency Domain for Classification of Individual Activity Recognition Fatai Sadiq, Ali Selamat, Roliana Ibrahim and Ondrej Krejcar	
16:35	81	Domain Specific Modeling Language for Strategy Educational Games and Transfer Learning Theory Nur Aisyah Nurhadi, Lukman Ab Rahim and Ana Syafiqah Zahari	

PARALLEL SESSION : 1C

TIME	<u>THEME</u> APPLICATION FOR PRIORITY SECTORS		Chair : Dr Irwandi Hipni Mohamad Hipiny
	VENUE : TUBAU 3		8th AUGUST 2018
15:15	6	Empowering the Knowledge Management System Within Higher Education Institution Towards Industry 4.0 Mohammad Fakhrulnizam Mohammad, Rusli Abdullah, Marzanah A Jabar, Rozi Nor Haizan Nor and Nor Aida Abd Rahman	
15:35	40	A Game-based Spatial Navigation Learning Tool for Children with Visual Impairment Carmen Chai, Bee Theng Lau and Zheng Pan	
15:55	41	Support Vector Machine Algorithm for SMS Spam Classification in Telecommunication Industry Nilam Nur Amir Sjarif, Yazriwati Yahya, Suriayati Chuprat and Nurulhuda Firdaus Mohd Azmi	
16:15	58	Semantically Enhanced Information Retrieval for Historical Domain: An Ontology Based Approach Fatihah Ramli, Shahrul Azman Mohd Noah and Tri Basuki Kurniawan	

PARALLEL SESSION : 1D

TIME	<u>THEME</u> SOFTWARE TOOLS AND ENVIRONMENT & APPLICATION FOR PRIORITY SECTORS		Chair : Assoc. Prof Dr Shahida Sulaiman
	VENUE : KERANGAS		8th AUGUST 2018
15:15	64	Zsmell - Code Smell Detection for Open Source Software Aziz Nanthaamornphong, Tanawat Saeang, Panyaprach Tularak and Tunyared Khiawthong	
15:35	72	Functional Size Measurement Tool-based Approach for Mobile Game Nur Ida Aniza Rusli and Nur Atiqah Sia Abdullah	
15:55	79	Comparing the Accuracy of Hierarchical Agglomerative and K-means Clustering on Mobile Augmented Reality Usability Metrics Kok Cheng Lim, Ali Selamat, Mohd Hazli Mohamed Zabil, Rose Alinda Alias, Fatimah Puteh, Farhan Mohamed, Ondrej Krejcar and Md Hafiz Selamat	
16:15	104	Primary School Timetabling Problem (PSTP) San Nah Sze, See Yan Tan, Kang Leng Chiew and Wei Tiong	
16:35	106	Vehicle Routing Problem with Simultaneous Pickup and Delivery San Nah Sze, Doreen Sek Siaw Ying, Kang Leng Chiew, Wei Tiong and Jeeu Fong Sze	

PARALLEL SESSION : 2A

TIME	THEME SOFTWARE PROCESS AND MEASUREMENT		Chair : Dr Cheah Wai Shiang
	VENUE : TUBAU 1		9th AUGUST 2018
08:30	4	An Ontology Framework for Generating Requirements Specification Amarilis Putri Yanuarifiani, Fang-Fang Chua and Gaik-Yee Chan	
08:50	7	Mutation Testing Ontology Sherolwendy Sualim and Radziah Mohamad	
09:10	33	Automated Test Cases Generation from Requirements: A Systematic Literature Review Ahmad Mustafa, Wan M.N Wan-Kadir, Noraini Ibrahim and Muhammad Arif Shah	
09:30	50	Case Study on NFR Change Impact Traceability Approach in Most of Agile Software Methodology Adila Firdaus Arbain, Dayang N. A. Jawawi, Imran Ghani and Wan M.N. Wan-Kadir	
09:50	53	Towards Adopting the Appropriate Performance Measures for Soft Computing based Estimation by Analogy Muhammad Arif Shah, Dayang Norhayati Abang Jawawi Jawawi, Mohd Adham Isa, Ahmad Mustafa and Muhammad Younas	
10.10	62	Secure Software Process: Implementing Security Coding in the Organization Nor Izyani Daud, Galoh Rashidah Haron and Dahlia Din	

PARALLEL SESSION : 2B

TIME	<u>THEME</u> SOFTWARE APPROACH		Chair : Dr Sarah Flora Samson Juan
	VENUE : TUBAU 2		9th AUGUST 2018
08:30	19	Automated Test Cases and Test Data Generation for Dynamic-Structural Testing in Automatic Programming Assessment Using MC/DC Rohaida Romli, Shahadath Sarker, Mazni Omar and Musyrifah Mahmod	
08:50	26	Risk Evaluation Using Nominal Group Technique for Cloud Computing Risk Assessment in Healthcare Nurbaini Zainuddin and Rasimah Che Mohd Yusuff	
09:10	34	A Domain Specific Modeling Language for Adventure Educational Games and Flow Theory Ana Syafiqah Zahari, Lukman Ab Rahim and Nur Aisyah Nurhadi	
09:30	69	An Improved Software Project Monitoring Task Model of Agile Kanban Method: A Practitioners' Perspective Mazni Omar, Hamzah Alaidaros and Rohaida Romli	
09:50	71	Agile Methods Selection Model: A Grounded Theory Study Mashal Alqudah and Rozilawati Razali	
10.10	78	Pairing-Based Approach to Support Understanding of Object-Oriented Concepts and Programming Shahida Sulaiman	

PARALLEL SESSION : 2C

TIME	<u>THEME</u> APPLICATION FOR PRIORITY SECTORS		Chair : Dr Azman Bujang Masli
	VENUE : TUBAU 3		9th AUGUST 2018
08:30	13	A Comparative Analysis of Varying Window Setting in Visualizing Computed Tomography (CT) Brain Images Anis Azwani Muhd Suberi, Wan Nurshazwani Wan Zakaria, Razali Tomari and Nik Farhan Nik Fuad	
08:50	49	A Review on End-User Service Composition Approaches Mei Ting Lim and Moon Ting Su and Shahabuddin Muhammad	
09:10	77	Efficient Enumeration of Algebraic Structures Using Multicore Systems Majid Khan, Nazeeruddin Mohammad, Abul Bashar	
09:30	80	Algorithm for an Automated Clarias gariepinus Fecundity Eggs Estimation Technique Using Cubic Spline Interpolation and Gaussian Quadrature Abdul Aziz K Abdul Hamid, Norfazlina Amirudin, Gobithaasan Rudrusamy, Masduki Mohammad Morni and Sumazly Sulaiman	
09:50	86	Web Content Quality Model for Massive Open Online Course (MOOC) Wan Nurhayati Wan Ab. Rahman and Ahmad Wiraputra Selamat	
10.10	98	Arabic Sign Language (ArSL) Recognition System using Convolutional Neural Network (CNN) Roaa Alkhalaf, Rawan Alkhalaf, Ghazanfar Latif, Nazeeruddin Mohammad, Jaafar Alghazo and Majid Ali Khan	

PARALLEL SESSION : 2D

TIME	THEME SOFTWARE PROCESS AND MEASUREMENT		Chair : Dr Hamimah Ujir
	VENUE : KERANGAS		9th AUGUST 2018
08:30	3	Governance of Collaborative Knowledge Management System: Measuring the Construct Azlina Ali, Rozi Nor Haizan Nor and Muhd Nabil Ahmad	
08:50	21	Proposing A Model of Information Communication and Technology Service (ICTS) Governance for Software Anti-Aging Mohamad Khairudin Morshidi, Rozi Nor Haizan Nor and Yusmadi Yah Jusoh	
09:10	27	The Development of Emotion Detection System based on Keyboard Actions (EDS-KA) Zuriana Abu Bakar and Ong Sze Seong	
09:30	31	Adopting a ISO/IEC 27005:2011-based Risk Treatment Plan to prevent Patients Data Theft Laura Cassandra Hamit, Haslina Md Sarkan, Nurulhuda Firdaus Mohd Azmi, Mohd Nazri Mahrin, Suriayati Chuprat and Yazriwati Yahya	
09:50	61	Development and Evaluation of Experience Based Factory Model for Software Development Process Mastura Hanafiah, Rusli Abdullah, Masrah Azrifah Azmi Murad and Jamilah Din	
10.10	107	Comparative Evaluation of Interactive Segmentation Algorithms Using One Unified User Interactive Type Soo See Chai, Kok Luong Goh and Hui Hui Wang	

PARALLEL SESSION : 3A

TIME	THEME SOFTWARE PROCESS AND MEASUREMENT & SOFTWARE TOOLS AND ENVIRONMENT		Chair : Mr Lee Jun Choi
	VENUE : TUBAU 1		9th AUGUST 2018
14:00	22	The Organisational Factors of Software Process Improvement in Small Software Industry: Comparative Study Shuib B Basri, Malek Momani, Abdullahi Abubakar Imam and Murugan Thangiah	
14:20	63	The Impacts of Requirements Relationships Knowledge on Requirements Quality and Software Development Project Success Ruhaya Ab. Aziz, Bernard Wong and Mao Lin Huang	
14:40	73	Evaluation of Software Requirement Specification Based on IEEE 830 Quality Properties Elly Stephen and Edwin Mit	
15:00	100	Empirical Exploration of Success Factors and its Solutions in the context of Green IT-Outsourcing Siffat Ullah Khan, Rahmat Ullah Khan and Rafiq Ahmad Khan	
15:20	88	Design and Implementation of Instructional Support to Enhance Programming Problem-Solving Skills: Applying Cognitive Load Theory and Worked-example Syahanim Mohd Salleh, Zarina Shukur and Hairulliza Mohamad Judi	

PARALLEL SESSION : 3B

TIME	THEME SOFTWARE APPROACH		Chair : Dr Suriati Khartini Jali
	VENUE : TUBAU 2		9th AUGUST 2018
14:00	20	Statistical Comparison of Architecture Driven Modernization (ADM) with other Cloud Migration Frameworks and Formation of Clusters Mubeen Aslam, Lukman Ab Rahim, Nur Aisyah Nurhadi and Ana Syafiqah Zahari	
14:20	29	Optimization on Attribute Selection Model using Bio-Inspired Algorithms Mohammad Aizat Basir, Yuhanis Yusof and Mohamed Saifullah Hussin	
14:40	87	TEGDroid: Test Case Generation Approach for Android Apps Considering Context and GUI Events Asmau Usman, Noraini Ibrahim and Ibrahim Anka Salihu	
15:00	102	A Semantic Extraction and Analysis for Traffic Density using Traffic Images: A Review Ruhana Abang Yusup, Wang Hui Hui and Wee Bui Lin	

PARALLEL SESSION : 3C

TIME	<u>THEME</u> APPLICATION FOR PRIORITY SECTORS		Chair : Mr Muhammad Asyraf Khairuddin
	VENUE : TUBAU 3		9th AUGUST 2018
14:00	65	A Development Methodology Framework of Smart Manufacturing Systems (Industry 4.0) Moamin Mahmoud, Ramona Ramli, Feninferina Azman and Jennifer Grace	
14:20	103	Heuristic Algorithm for Multi-Location Lecture Timetabling San Nah Sze, Huiggy Kuan, Kang Leng Chiew and Wei King Tiong	
14:40	108	Detecting the Usage of Vulgar Words in Cyberbully Activities from Twitter Nursyahirah Tarmizi, Suhaila Sae and Dayang Hanani Abang Ibrahim	
15:00	54	Fish Larvae Counting System Using Modified Canny Edge Detection and Blob Processing Techniques Ezmahamrul Afreen Awalludin, Wan Nural Jawahir Hj Wan Yussof, Muhammad Suzuri Hitam and Nur Fariah Abdul Rahman	
15:20	52	COMBI Behavioral Change Model: using Persuasive Technology for Dengue Prevention in Community Afzan Rosli, Masitah Ghazali and Noraini Ibrahim	

PARALLEL SESSION : 3D

TIME	<u>THEME</u> SOFTWARE APPROACH		Chair : Mr Abdul Rahman Mat
	VENUE : KERANGAS		9th AUGUST 2018
14:00	39	Knowledge Representation Framework for Software Requirement Specification Lilyana Jelai, Edwin Mit and Sarah Flora Samson Juan	
14:20	55	PUTRACOM: A Novel Component Model Faranak Nejati, Abdul Azim Abd Ghani, Keng Yap Ng and Azmi Jaffar	
14:40	83	Sustainable Software Engineering: A Perspective of Individual Sustainability Challenges Sumaira Nazir, Suriayati Chuprat and Nargis Fatima	
15:00	2	Old Handwritten Music Symbol Recognition Using Directional Multi-Resolution Spatial Features Chitra Dhawale, Dr. Mallikarjun Hangarge, Savitri Nawade, Rajmohan Pardesi and Md Mamun bin Ibne Reaz	
15:20	105	Modelling Emotion Expression Quiz Master for eLearning through Agent Oriented Approach Syazwani Filzah binti Zulkifli, Cheah Wai Shiang, Nurfaiza binti Jali and Muhammad Asyraf bin Khairuddin	

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Old Handwritten Music Symbol Recognition Using Directional Multi-Resolution Spatial Features

Chitra Dhawale, Dr. Mallikarjun Hangarge, Savitri Nawade, Rajmohan Pardesi and Md Mamun Bin Ibne Reaz

Automatic recognition of musical symbols received huge attention in the last two decades. Most of the work is carried out for the recognition of printed symbols whereas little attention is given to handwritten symbols. In handwritten musical symbols, when we deal with historical and old handwritten musical symbols, the problem becomes more challenging. In this paper, we have dealt with recognition of old handwritten musical symbols. In our method, we have used directional multiresolution statistical descriptors by combining Radon Transform, Discrete Wavelet Transform, and Statistical Filters. Simple k-NN classifier is used with five-fold cross validation. We have achieved encouraging results on our dataset.

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Governance of Collaborative Knowledge Management System: Measuring the Construct

Azlina Ali, Rozi Nor Haizan Nor and Muhd Nabil Ahmad

The main aim of this study is to analyze the governance component for collaborative knowledge management system. This quantitative study used a constructed questionnaire as the main tool to collect data. A set of questionnaire were distributed to 160 respondents and received 136 responses. The respondents were selected from 22 government agencies, which consists of ministries, research institutes and ICT industry regulatory bodies for Malaysia Public Services. The results indicated, policies and strategies, strategic management, knowledge culture and collaborative environment, had the highest positive and significant direct effect of such systems. The rest of the construct, financial management, organizational learning, organizational infrastructure, KM process and technology infrastructure gave moderately significant direct effect. In executing governance for collaborative KMS, emphasis on policies and strategies, strategic management, knowledge culture and collaborative environment should be considered as important aspect of implementation. As a result, this will minimised information redundancies, increase organisation productivity and improved efficiencies through centralised management and maintenance of shared resources.

An Ontology Framework for Generating Requirements Specification

Amarilis Putri Yanuarifiani, Fang-Fang Chua and Gaik-Yee Chan

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Requirements engineering plays a crucial role in software development process. However, this process is error-prone. This is generally related to communication, knowledge, and documentation. With the lack of business knowledge, it is very difficult for (technical) engineers to define customer needs. Also, modeling, and documenting requirements need much time and effort to ensure that the requirements are valid, and nothing is missed. The purpose of this study is to provide guidance for elicitation process to avoid missing and mismatch requirements, and to make the modeling and documentation process more effective and efficient. In this paper, the authors propose an ontology framework for generating requirements specification consist of two main processes: First, Requirements elicitation process. Second, An Auto-generated requirements specification document which consist of semi-formal modelling (BPMN) and natural language template.

Empowering the Knowledge Management System Within Higher Education Institution Towards Industry 4.0

*Mohammad Fakhruhnizam Mohammad, Rusli Abdullah, Marzanah A Jabar, Rozi Nor Haizan
Nor and Nor Aida Abd Rahman*

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This study aimed to investigate the needs for Higher Education Institution (HEI) in preparing for the emergence of Industrial Revolution 4.0 (IR4.0). It is known that the emergence of IR4.0 involve the automation of processes within the industry – heavily relying on the use of centralized systems known as Cyber Physical Systems (CPS). HEI is seen as the closest entities to provide the fundamental needs of workforce requirements for future industry; and preparing students in facing the upcoming revolution. This study investigates from the perspectives of building a proper knowledge management system (KMS) in enhancing the performance of HEI. Furthermore, organization's sustainability also heavily depending on the intellectual capital of employees. This study is conducted by reviewing several past articles, documents and publication in the emergence of IR 4.0 that are related to HEI. Several areas of concern are covered such as the needs of knowledge management (KM), the HEI performance indicators and the design and requirements of IR4.0 were discussed. Based on preliminary findings, it is indicated that there are justification and needs to investigate on the establishment of dedicated platform in managing knowledge; both in HEI and the industry. New and upcoming challenges (seamless systems communication, less number of humans and knowledge about the system used) faced by the industry in the emergence of IR 4.0 undeniably contributed heavily on justifying the proposed solution.

Operators are special characters within the Java language to manipulate primitive data type. Java operators can be classified as unary, binary and ternary. The design of operator sometimes a little bit confusing when come to testing tool. Therefore, in order to map the knowledge of operators correctly, we proposed an ontology that dedicated to mutation testing as a means to define the formal specification of concepts and documenting knowledge of Java operators. Existing papers on ontology did not specify further on entities and properties of operators. Some papers only focus on mutation testing only but not the operators. Thus, we present our ontology clearly with the aim to ease end user to identify and understand every class, properties, and relations in Java operators.

This paper studies a comparison of machine learning techniques to enhance prediction method of the ionosphere for space weather monitoring. The empirical model has been used to provide the ionosphere parameters in order to predict the ionosphere. However, there is a large deviation of total electron content prediction of ionosphere data for the areas located in the equatorial and low-latitude region due to the lack of observation data contributed by these areas during the development of this empirical model. Machine learning technique is an alternative method used to develop the predictive model. Thus, in this study, the machine learning techniques that can be applied to improve the predictive model are investigated. The study is aimed to improve the predictive model in terms of reducing the total electron content deviation, increasing the accuracy and minimizing the error. The method used in this review is by comparing the techniques that have been used by other researchers for the development of prediction model. From the review that has been done, the artificial neural network is found to be the suitable technique as it is mostly been used in the development of the predictive model. Besides that, it is also the most favorable technique used in ionosphere study. In addition, it produces an accurate model for time series data and less error compared to other techniques. However, due to the size and complexity of the data, the deep neural network technique that is an improved artificial neural network technique is suggested to be chosen. By using this technique, an accurate and efficient ionosphere predictive model in equatorial and low region area is expected can be achieved. In the future, the study will further analyze by using simulation tools and real-time data.

A Comparative Analysis of Varying Window Setting in Visualizing Computed Tomography (CT) Brain Images

Anis Azwani Muhd Suberi, Wan Nurshazwani Wan Zakaria, Razali Tomari and Nik Farhan Nik Fuad

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The detection of ischemic stroke lesion in Computed Tomography (CT) brain image is notoriously challenging for radiologists specifically in the using of difference window settings to visualise the subtle lesion. Generally, the default window setting provides poor detection performance of ischemic stroke lesion as it permits a low contrast image. Furthermore, the visibility of ischemic lesion sometimes can resemble as normal brain tissues which can introduce any possibility for the radiologist to misidentify this finding. Prior existing researches propose several window setting values to solve this issue. However, each proposed window setting usually results in different output due to the variation of brain size and technology used in the CT imaging. Therefore, this study is conducted to test and compare the most suitable window setting values which can be applied to improve the ischemic lesion diagnosis. The DICOM image conversion is applied with different window setting values of window width and window center. The image analysis demonstrated that and can enhance the image well without any over or under enhancement problem as compared to other prior window setting values.

An Empirical Study on Functional Testing Process Model for Mobile Apps Testing

Mastura Abu Kasim and Noor Hasrina Bakar

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Number of mobile apps are increasing due to its mobility and ease access. This rapid growth of mobile apps resulting in many of them has become legacy apps – due to incompatibility issues or outdated features/functionality. In order to produce quality application which meet user's requirement and up to current trend, appropriate testing process is very crucial. Therefore, this study proposes a testing process model with functional test elements. Currently, most existing test models refers to specific testing procedure. Up to the day this paper is written, to the best of our knowledge there exist no such model that represents the overall flow for implementing mobile apps testing. Semi-structured interview was conducted with individual and focus group participant to identify the flow processes of mobile apps testing and the functional testing components. Findings from the interviews were analyzed by using content analysis. Based on the findings, a model comprises of six activities within mobile apps testing process flow and seven activities for functional testing has been introduced.

Automated Test Cases and Test Data Generation for Dynamic-Structural Testing in Automatic Programming Assessment Using MC/DC

Rohaida Romli, Shahadath Sarker, Mazni Omar and Musyrifah Mahmud

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Automatic Programming Assessment (or APA) has being recognized as an essential method in supporting educators to implement automated assessment and grading on students' programming assignments. With respect to executing a dynamic testing in APA, it is essential to prepare a set of test data through a systematic test data generation process. Though researches respecting to software testing have proposed

various significant methods to realize automated test data generation, it is occurred that recent studies of APA rarely utilized these methods. Merely some of limited studies appeared to resolve this circumstance, yet the focus on realizing test set and test data covering of more thorough dynamic-structural testing is still deficient. Thus, we propose a method that utilizes MC/DC coverage criteria to support more thorough automated test data generation for dynamic structural testing in APA (or is called DyStruc-TDG). In this paper, we reveal the means of deriving and generating test cases and test data for DyStruc-TDG and its verification in terms of the criteria of reliability (or called positive testing) of test data adequacy in programming assessments. This method offers a significant impact to assist educators dealing with introductory programming courses to derive and generate test cases and test data via APA by having none particular knowledge of test cases design in conducting a structural testing. As regard to this, the educators' workload can be reduced effectively since the typical manual assessments are always prone to errors and leading to inconsistency.

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Statistical Comparison of Architecture Driven Modernization (ADM) with other Cloud Migration Frameworks and Formation of Clusters

Mubeen Aslam, Lukman Ab Rahim, Nur Aisyah Nurhadi and Ana Syafiqah Zahari

Enterprises and individuals are enjoying a wide range of virtualized computing facilities provisioned by cloud computing. Corporations are migrating their legacy software systems towards the cloud environment for amelioration, to avail benefits of cloud. Architecture Driven Modernization (ADM), framework offers an organization with a range of possibilities for consideration, development and eventually migration of critical software systems. ADM serves as a vehicle for facilitating the arrangement of IT with business stratagem and its architecture. Clustering technique is used to appraise and compare ADM with some of the other existing cloud migration frameworks for highlighting their features, similarities and key differences. Quality of clusters is evaluated by rand index measurement. The study distills the record and makes a rich inventory of important activities and concerns that are common in cloud migration frameworks. The results enable both academia and practitioners in the cloud computing community, to get a predominant view of the legacy application migration frameworks towards the cloud and to investigate new research areas.

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Proposing A Model Of Information Communication and Technology Service (ICTS) Governance For Software Anti-Aging

Mohamad Khairudin Morshidi, Rozi Nor Haizan Nor and Yusmadi Yah Jusoh

ICT services is very important in ensuring organization maintain their competitive advantage. Most organizations take full advantage of the rapid improvement in ICT to stay ahead. This also increases the importance if ICT service to organization. On the other hand, software aging is not a new phenomenon both in practice and by researchers. It has been extensively investigated for the past 20 years. Unfortunately, less focus has been given towards the external factors of the software which lead the process of aging in software. Thus this study is focusing on relating the ICT service governance and the software anti-aging. This study proposed a model of ICTS governance for software anti-aging. The components to be

considered in the development of this model are explained in details in this study. Four main components are considered for this model which is components of ICTS governance, software aging factors, level of aging and the preventive technique for software aging.

The Organisational Factors of Software Process Improvement in Small Software Industry: Comparative Study

Shuib B Basri, Malek Momani, Abdullahi Abubakar Imam and Murugan Thangiah

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Small and Medium Enterprises (SMEs) are a great contribution to international economy and have also been considered an important component in today's world business. Thus, in order to be more competitive, it is necessary for these companies to deliver their products with high-quality. However, despite their importance, small software companies still face myriad challenges and barriers in producing high-quality products. The objective of this study is to identify the organizational factors that have positive impact to enable SPI effort in the small software industry. A Systematic Literature Review (SLR) has been conducted based on the guideline proposed by Kitchenham to achieve the main objective of this study. From 81 selected studies, 11 critical factors were identified. In conclusion, we identified that both 'Business Orientation' and 'Management Commitment' factors were the most critical organizational factors that have direct effect on successfully implementing SPI in small software development industry. Furthermore, there was a significant difference in "Organization Structure" factor between developed and developing countries. The findings from this study provides a roadmap to guide future research in order to enable SPI effort in small software development industry. We believe that findings from this study will give interesting insights to encourage researchers in using compromise technique to analyze future empirical studies based on specific region to validate the suitability of identified factors in the specific country.

A Study on Reuse-based Requirements Engineering by Utilizing Knowledge Pattern

Sabrina Ahmad and Zariza Hashim

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Software development has become an important part of many industries over the past decade. The use of software has become an important element for the organization to support their operation and business. Some software has certain features in common, which allow its requirements to be used repetitively in requirement engineering phase. This paper presents a study on knowledge pattern for reuse-based requirements engineering. Literature review method is used to investigate and to present current studies on knowledge pattern for the purpose of reuse. The study found that a specific pattern is required to develop good requirements specification. A proposed prototype to deploy reuse-based requirements engineering is also presented and evaluated. Experts' judgment method is used for evaluation by adapting the Technology Acceptance Model (TAM). The results showed that reusing knowledge pattern expedites the requirements elicitation process and improves the requirements quality.

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Risk Evaluation Using Nominal Group Technique for Cloud Computing Risk Assessment in Healthcare

Nurbaini Zainuddin and Rasimah Che Mohd Yusuff

There are limited study in cloud risk assessment process, especially considering specific process in the risk assessment. Therefore, this study proposed method in the third phase of risk assessment process in cloud computing. Risk evaluation is importance phase in the risk assessment process. It compare the result from risk analysis process and determine whether to accept or tolerate with the risk criteria decide in the risk analysis process. By using Nominal Group Technique (NGT) in this phase, it is hope that this technique will bring benefit to healthcare in facilitating risk assessment process.

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A Web-based Emotions Detection System using Keyboard Actions (EDS-KA)

Zuriana Abu Bakar and Ong Sze Seong

Emotions is one of the user experience key factors. Emotions is subjective feeling and it is difficult to determine human's emotions. Thus, there is a need to have a system that could automatically detect human emotions. Nowadays, most of the emotion detection systems are obtrusive and complex. Besides that, most of the data collection and analysis process for research has been done manually. Therefore, Web-based Emotion Detection System using Keyboards Actions (EDS-KA) has been developed to detect human emotions without their awareness, in which, it is based on human actions using computer keyboard. In addition, this system could assist researchers in data collection and analysis, whereas, data could be collected and analyzed automatically. Further, the analysis results were saved in the database and could be printed out. EDS-KA adopted the Rational Unified Process (RUP) system development methodology. EDS-KA was a web-based system, in which, users could access the system at any time and places that have internet connection. In terms of emotional considerations, EDS-KA focus on five (5) basic emotional states, namely happy, sad, afraid, relaxed and neutral (emotionless). Taken together, this system could assist the researchers' tasks in conducting emotions detection research more efficient, taking less time and inexpensive.

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Optimization on Attribute Selection Model using Bio-Inspired Algorithms

Mohammad Aizat Basir, Yuhanis Yusof and Mohamed Saifullah Hussin

Attribute selection which is known as feature selection is an essential process in large datasets that comprises of numerous number of attributes. To date, various feature selection algorithms work independently, hence does not guarantee consistency in the accuracy rate. Hence, the aim of this paper is to investigate the use of bio-inspired search algorithms in producing optimal attribute set. This is achieved in two stages; 1) create attribute selection models by combining search method and attribute reduction algorithms, and 2) determine an optimized attribute set by employing bio-inspired algorithms. Classification performance of the produced attribute set is analyzed based on accuracy and number of selected attributes. Experimental results conducted on six (6) public real datasets reveal that the attribute selection model with the implementation of bio-inspired search algorithm consistently perform good classification (i.e higher accuracy with fewer number of attributes) on the selected data set. Such a finding

indicates that bio-inspired algorithms can contribute in identifying the few most important variables or parameters which help in data mining tasks.

Test Case Prioritization Approach for Sequence of Events using Complexity Factor

Emyreema Ja'AFar, Saadah Hassan, Salmi Baharom and Johanna Ahmad

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Test case prioritization (TCP) is a method to prioritize and schedule test cases. It is aim to minimize the time, cost, and effort for testing software based on the test cases that are higher priority. Complexity is one of the factors that affect the effectiveness of the TCP. However, the existing techniques for measuring complexity have some limitations. This is due to inaccuracy in finding the weightage value for complexity as the value will be used to determine the test case prioritization. This paper presents work on TCP using complexity factor to enhance the accuracy in prioritizing the test cases for event sequences. This work uses Branch Coverage Expectation (BCE) for complexity measurement, in which BCE has been proven empirically its use in the previous research. While, Average Percentage of Fault Detected (APFD) metric is used to evaluate the proposed approach. Based on the results, it shows the need to combine complexity factor with other factor(s) in order to improve the effectiveness of proposed TCP.

Adopting a ISO/IEC 27005:2011-based Risk Treatment Plan to prevent Patients Data Theft

Laura Cassandra Hamit, Haslina Md Sarkan, Nurulhuda Firdaus Mohd Azmi, Mohd Nazri Mahrin, Suriayati Chuprat and Yazriwati Yahya

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The recent concern regarding 46.2 million mobile device subscribers' data breach had the Malaysian police started an investigation looking for the source of the leak. Data security is very important to protect the assets or information by providing its confidentiality, integrity and availability not only in the telecommunication industry, but also elsewhere. This paper attempts to protect the data of a patient based clinical system by producing a risk treatment plan for its software products. The existing system is vulnerable to information theft, insecure databases, poor audit login and password management. A risk management framework was applied to the software development unit of the organization to countermeasure these risks. ISO/IEC 27005:2011 standard is used as the basis for the information security risk management framework. 30 risks have been identified and 7 high level risks for the product have been recognized. A risk treatment plan has been developed for the system to reduce these risks in order to secure the patients' data.

Automated Test Cases Generation from Requirements: A Systematic Literature Review

Ahmad Mustafa, Wan M.N Wan-Kadir, Noraini Ibrahim and Muhammad Arif Shah

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Requirement-based testing is the approach, in which test cases are derived from requirements without regard to the internal structure of the implementation. It includes functional tests and non-functional attributes such as usability, performance, and reliability of system under test. The objective

of this study is to conduct a review of the relevant approaches of test cases generation techniques from requirements. We have performed systematic literature review based on two research questions and extensive quality assessment criteria to include studies. We identified 30 relevant studies from 410 studies spanned over the year 2000 to 2017 and required information from primary studies was extracted and summarized. Our review identified that 53% journal papers, 42% conference papers and 5% books chapters are addressing requirements based testing. Most of the studies are using UML activity and use case diagrams for test cases generation from requirements. One of the significant lesson learned that most of the errors during software testing are traced back to errors in natural language requirements. Another finding that a substantial amount of work is focusing on UML diagrams for test cases generations which lack to capture all attributes of the system to be developed. Therefore, there is a need to develop a model that can generate test cases from natural language requirements by refining them in context.

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A Domain Specific Modeling Language for Adventure Educational Games and Flow Theory

Ana Syafiqah Zahari, Lukman Ab Rahim and Nur Aisyah Nurhadi

Designing educational games is complex and needs collaboration between game developer and educator. Domain Specific Modeling Language (DSML) offers an approach to simplify the design activities of educational games and support the involvement of both game developers and educators. This paper presents an extension of Serious Game Logic and Structure Modeling Language (GLiSMo), a DSML that design the logical and structure views of adventure educational game. However, as a DSML for educational games, the DSML should also include a learning theory but the original GLiSMo does not include any learning theories. Furthermore, GLiSMo does not cover all concepts in the adventure genre. We intend to extend GLiSMo by adding the concepts of Flow Theory and concepts of the adventure genre to make it more expressive. Then, we evaluated the expressiveness of the extended GLiSMo using Framework for Qualitative Assessment of DSLs (FQAD). We also demonstrate the diagrams of concrete syntax of extended GLiSMo using the Tales of Monkey Island game as a case study. As a conclusion, this research presents fifteen (15) finalized concepts of the logic extended GLiSMo, nineteen (19) finalized concepts of the structure extended GLiSMo and five (5) finalized concepts of the Flow Theory.

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Risk Factors for Software Requirements Change Implementation

Marfizah Abdul Rahman, Rozilawati Razali and Fatin Filzahti Ismail

Requirements change has been regarded as a substantial risk in software development projects. The factors that contribute to the risk are identified through impact analysis, which later determine the planning of the change implementation. The analysis is however not straightforward as the risk factors that constitute requirements change implementation are currently not much explored. This paper identifies the risk factors by firstly collating them qualitatively through a review of related work and a focus group study. The factors are then confirmed quantitatively through a survey in which data are analysed by using Partial Least Squares Structural Equation Modelling (PLS-SEM). The survey comprise of 276 practitioners from software industry who are involved in the impact analysis. The results indicate

that User, Project Team, Top Management, Third Party, Organisation, Identification of Change, Existing Product and Planning of Change Implementation are the significant risk factors in planning of requirements change implementation.

Knowledge-based method for Knowledge Representation of SRS

Lilyana Jelai, Edwin Mit and Sarah Flora Samson Juan

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One of the main issues in software requirement specification (SRS) documentation is to access the correct information. The larger the information obtained, the larger the knowledge gathered. However, if the knowledge management failed, this issue might affect a set of operations within an organization and complicate the organization to achieve objectives. Large information requires quality software to manage and extract the knowledge from it. With the advancement of knowledge-based technology, storage and access data can be managed systematically. This paper will discuss an framework based on the knowledge-based method, an attempt to improve the knowledge representation. In this approach, WordNet 2.1 would be used as the knowledge source used to identify concepts represented by each word in a text.

A Game-based Spatial Navigation Learning Tool for Children with Visual Impairment

Carmen Chai, Bee Theng Lau and Zheng Pan

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This study identifies the limitations of existing spatial navigation learning tools for visually impaired children. After the limitations of such tools are investigated, a mobile serious game prototype named 'Hungry Cat' is designed, built and tested with children with visual impairment. The game narrates a scenario where a hungry cat, controlled by the player, explores rooms of a house to find food. Two tests performed in this study are the food finding test which is a game mode played using the prototype developed, and the wire net test, which shows the participants' spatial mental mapping of the room. The study also compares spatial memory among different groups of visually impaired children such as between low vision and no vision, as well as those with learning difficulties and those without. Results of the study show that playing the game developed can help visually impaired children to gather details about a room in an interactive and engaging manner from a safe environment.

Support Vector Machine Algorithm for SMS Spam Classification in Telecommunication Industry

Nilam Nur Amir Sjarif, Yazriwati Yahya, Suriayati Chuprat and Nurulhuda Firdaus Mohd Azmi

In the recent years, we have witnessed a dramatic increment volume in the number of mobile users grows in telecommunication industry. However, this leads to drastic increase number of spam SMS messages. Short Message Service (SMS) is considered one of the widely used communication in telecommunication service. In reality most of the users ignore the spam because of the lower rate of SMS and limited amount of spam classification tools. In this paper, we propose a Support Vector Machine (SVM) for SMS Spam Classification. The dataset used for the experiment is based on the public, non-encoded largest SMS Spam dataset so far called SMS Spam Collection v.1. The propose algorithm have been evaluated and the performance achieved is compared. The experiment result indicates that the Support Vector Machines (SVM) outperform better than other classifiers with the result achieved 98.91 %.

Improved Feature Extraction Method with Statistical Based Time Frequency Domain for Classification of Individual Activity Recognition in a Crowd Scenario

Fatai Sadiq, Ali Selamat, Roliana Ibrahim and Ondrej Krejcar

The application of context-aware and smartphones using embedded sensors have the potentials to monitor tasks that are practically complicated to access. Human beings may not be safe except they are informed early of impending dangers around them. However, inaccuracy of individual activity recognition (IAR) from accelerometer sensor signals data and hidden information present in the data due to classification problem still limits the opportunities for efficient prediction of individual abnormality behaviours in a crowd scenario. This paper proposes an improved feature extraction method with statistical-based time frequency domain (SBTFD) that represent and extract hidden information of sensor signals with improved accuracy for classification of individual activities in a crowd-prone area based on activity recognition (AR). The features were tested for their ability to differentiate different IAR classes of data using random forest, decision tree (J48), sequential minimal optimization and naive bayes classifiers. The experiment on the proposed method of the SBTFD with J48 achieved a maximum of 99.2% accuracy which outperforms the state-of-the-art method in activity recognition. We are able to classify the V1, V2, and V3 up to V8 based on SBTFD with high accuracy of 99.2% against 92% to minimize false negative alarm in a crowd monitoring system. In conclusion, the proposed SBTFD proves to be a viable solution if embrace for crowd abnormality monitor in our society.

A Review on End-User Service Composition Approaches

Mei Ting Lim and Moon Ting Su

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End-User Service Composition (EUSC) allows end-user programmers who are not professional developers compose applications by aggregating existing web services. However, there are limitations in existing EUSC work that supports integration between developing the user interface (UI) of an application and the composition of the web services needed for the application. The main problems of front-end service composition are lack of control flow visualization and the need for end-user programmers to have certain technical knowledge in the service composition process. This paper reviews the existing EUSC approaches and proposes an approach for EUSC that supports concurrent UI development and service composition. The approach will leverage integration, visualization and synchronization of UI development and service composition to simplify the process of service composition for average web users.

Case Study on NFR change impact traceability approach in most of Agile software methodology

Adila Firdaus Arbain, Dayang N. A. Jawawi, Imran Ghani and Wan M.N. Wan-Kadir

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Currently, it is crucial to develop a complex software on time. Agile software development methodologies provide methods to develop a system in term of time and cost saving but it has been criticized for software quality management. In this paper, a case study is used to find out the need of NFR change impact traceability approach in most of Agile software methodology. This case study was conducted in an undergraduate course that trained the students on how to develop software using Agile process model. The case study shows the lack of traceability techniques in the existing Agile process model (SFDD-Secured Feature Driven Development) that result to non-awareness of NFR change impact during development. Based on the case study mentioned, TANC offered techniques in tracing change impact during the agile development process. Based on the result of the case study, a traceability process model needs to design in order to tackle the NFR change impact issues in Agile software development.

COMBI Behavioral Change Model: using Persuasive Technology for Dengue Prevention in Community

Afzan Rosli, Masitah Ghazali and Noraini Ibrahim

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Dengue prevention is the best way to prevent dengue outbreak, as the tagline goes, "prevention is better than cure". But the challenges lie on sustaining the preventive activity among the community, which commonly only takes place periodically, i.e. when they are dengue outbreaks, with the presence of health officers under the Communication for Behavioral Impact (COMBI) campaign. In this study, a behaviour change model based on the Transtheoretical Model (TTM) and trigger elements derived from the Fogg Behaviour Model (FBM) is proposed to sustain a community in carrying out preventive activities to prevent dengue. Furthermore, the intervention strategy is added to connect the TTM and FBM. In addition, an interview with the community leader, from the community which used to be a hotspot for dengue, and a survey with its residents are performed to give further insights in the development of the proposed model.

Towards Adopting the Appropriate Performance Measures for Soft Computing based Estimation by Analogy

Muhammad Arif Shah, Dayang Norhayati Abang Jawawi Jawawi, Mohd Adham Isa, Ahmad Mustafa and Muhammad Younas

Soft Computing based estimation by analogy is a lucrative research domain for the software engineering research community. There is a considerable number of models proposed in this research area. Therefore, researchers are of interest to compare the models to identify the best one for software development effort estimation. This research showed that most of the studies used mean magnitude of relative error (MMRE) and percentage of prediction (PRED) for the comparison of their estimation models, but it was also found in this study that there are quite a number of criticisms done on accuracy statistics like MMRE and PRED by renowned authors. It was found that MMRE is an unbalanced, biased and inappropriate performance measure for identifying the best among competing estimation models. The accuracy statistics, e.g. MMRE and PRED are still adopted in the evaluation criteria by the domain researchers, stating the reason of “widely used” which is not a valid reason. This research study identified that, since, there is no practical solution provided so far, which could replace MMRE and PRED the researchers are adopting these measures. The approach of partitioning the large dataset into subsamples was tried in this paper using EBA model. Two datasets small and large were considered for it, such as Desharnais and ISBSG release 11. The ISBSG dataset is a large dataset with respect to Desharnais. The ISBSG dataset was partitioned into subsamples. The results suggested that when the large datasets are partitioned, the MMRE produces the same or nearly same results which it produces for the small dataset. It is observed that the MMRE can be trusted as a performance metric if the large datasets are partitioned into subsamples.

Fish Larvae Counting System Using Modified Canny Edge Detection and Blob Processing Techniques

Ezmahamrul Afreen Awalludin, Wan Nural Jawahir Hj Wan Yussof, Muhammad Suzuri Hitam and Nur Farihah Abdul Rahman.

This paper presents an estimation distribution of larvae counting system from the manual approach to the computer based approach. The high demand of computer aids in counting larvae are required in estimating fish population. In general the manual counting system has several limitations in larvae counting such as time consuming, laborious, involve human intervention and commonly error to prone. Therefore development of the proposed counting system is required to estimate distribution of larvae from different sample dataset. The proposed method is developed based on combining techniques that composed of several processes such as thresholding, segmentation, edge detection, morphological operator and blob processing. The performance of the proposed system is evaluated using three samples dataset that composed of small, medium and large samples. All the samples are obtained from the Freshwater hatchery that located at Universiti Malaysia Terengganu (UMT). The experimental is conducted by measuring the time of each sample as well as total number of the objects. For data validation, the experts in larvae counting number are chosen to run the manual counting system. To make the analysis of study more variation, the test of analysis of variance (ANOVA) is used to determine whether have significant different ($p < 0.05$) between

the proposed method and the manual approach. Based on the experimental observation, the proposed method shows the faster time in larvae counting process and number of objects in the sample are equally distributed which almost similar to the manual approach counting. The proposed method is promising with its performance in orders to calculate larvae from the small samples dataset to a large samples dataset.

PUTRACOM: A formalism of a novel component model

Faranak Nejati, Ng Keng Yap, Abdul Azim Abd Ghani, and Azmi Jaffar

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The composition mechanisms of current component models are mostly port-to-port connection or method-call. However, in the both styles, the number of interactions depends on the number of ports and method calls may increase dramatically. Due to this, to avoid such a complexity of composing component and coordination the interaction among them, a coherent component model and proper policy to provide a strong separation between component and coordination is needed. In this study, we present a formal specification of a novel component model for discrete-event and non-blocking component-based systems called PUTRACOM. PUTRACOM provides a way to construct components and coordinate them with a well-founded mechanism. The model defines a set of exogenous connectors and observer/observable unit to encapsulate components and coordination. We used an example to illustrate the way of component composition in the proposed model.

Semantically Enhanced Information Retrieval for Historical Domain: An Ontology Based Approach

Fatihah Ramli, Shahrul Azman Mohd Noah and Tri Basuki Kurniawan

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In this paper, we present an ontology-based retrieval and its application in the historical domain. In general, we deal with retrieval performance issue. We proposed ontology-based approach to index and ranked semantically rich historical documents. The proposed approach improves the precision and recall of document retrieval. The system is implemented using the state-of-the-art technologies in Semantic Web, and its performance is evaluated by comparing it with the conventional keyword-based approach. Furthermore, we provide a detailed evaluation to show the performance of the system. Finally, conducted experiments show that our system obtained better performance results (in terms of MAP) than the BM25 IR model.

Development and Evaluation of Experience Based Factory Model for Software Development Process

Mastura Hanafiah, Rusli Abdullah, Masrah Azrifah Azmi Murad and Jamilah Din

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Knowledge and experiences in software development have been accumulated over the time throughout the project lifecycle. Previous studies have shown that the management of knowledge and experiences in software development has always been an issue in a way that the knowledge transfer and information flow is inefficient, misinterpretation and inconsistencies occur between individuals or teams and organization fails to learn from past projects. It is understood that efficient knowledge and experience

management for software development organizations is crucial for the purpose of sharing and future reuse. This paper discusses the prototype development for a model that is based on experience factory approach to manage knowledge and experience for software development process in a cloud computing environment. Discussions include the system functionalities and design, infrastructure requirement and implementation approach. The efficiency and effectiveness of the prototype is evaluated based on Jennex and Olfman knowledge management success model which is conducted via a survey research. Rasch analysis is used for reliability and validity. Results show positive feedback on the model's efficiency and effectiveness. Additionally, most respondents agree that the model can contribute in such a way that it can encourage learning organization, prevent knowledge loss and aid in decision making.

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Secure Software Process: Implementing secure coding in the organization

Nor Izyani Daud, Galoh Rashidah Haron and Dahlia Din

This paper presents the implementation of secure software process in the organization; focusing on secure coding phase. In this paper, we study what is the other technique that implemented by other organization in order for them to practice secure software development activity in their organization. We also explained in detailed how we implement security coding phase in our secure software process activity. We share experience, challenges and also lesson-learned on how we implement secure coding phase in all our projects. The case study helps for better understanding of our current practice.

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The Impacts of Requirements Relationships Knowledge on Requirements Quality and Software Development Project Success

Ruhaya Ab. Aziz, Bernard Wong and Mao Lin Huang

Requirements quality is one of the factors that may determine the success or failure of a software project. Thus, maintaining requirements quality is important but also a challenge as an individual requirement does not stand alone and they are related to one another in several ways. The problem may become more challenging as the requirements and their interrelationships are not static and will continually change. However, current research much focusing on the assessment of the impact of requirements quality on success. There is lack of research assessing the impact of the interrelationships between requirements on success. Therefore, this research aims to investigate how the interrelationships between requirements impact requirements quality as well as the success of software development project. An empirical study to examine further the impacts was conducted from the perspective of business analyst. Using Structural Equation Modelling (SEM) and especially Partial Least Square (PLS), we found that there are significant impacts of requirements relationships towards requirements quality as well as success. The outcome from this research can be used as a guide to working with requirements relationships, knowledge useful for business analysts and research community.

Zsmell - Code Smell Detection for Open Source Software

Aziz Nanthaamornphong, Tanawat Saeang, Panyaprach Tularak and Tunyared Khiawthong

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Today, open source software (OSS) is used in various applications. It is also a source of additional knowledge for collaborators because this type of software is easily accessible through websites that provide management of version control services such as GitHub. However, a recent study shows an increasing trend in the use of code smells. In OSS, there is a growing number of code smells that cause software errors and affect software maintenance. Finding code smells in the early stages of software development would provide for better software maintenance and reliability; thus, researchers invented the Zsmell software system that helps search for code smells in the source code saved in GitHub. Developed systems display data related to code smells in each source code version that was modified by collaborators. Researchers believe that this system will enable open source collaborators to improve the quality of their OSS.

A Development Methodology Framework of Smart Manufacturing Systems (Industry 4.0)

Moamin Mahmoud, Ramona Ramli, Feninferina Azman and Jennifer Grace

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Today, a new era of manufacturing innovation is introduced as Smart Manufacturing Systems (SMS) or Industry 4.0. Many studies have discussed the different characteristics and technologies associated with SMS, however, little attention has been devoted to study the development methodology when establishing new SMS that requires pre-implementation planning and assessment leading to minimized operational cost and time, as well as efficient machine's utilization. The study's objective is to propose a development methodology that increases the adoption and awareness of Industry 4.0 among manufacturers and aids decision-makers in designing better SMS capabilities. The framework consists of three phases, iterative process of application modelling; evaluation to ensure optimal configuration and adoption; and finally implementation. This study supports the realization of Industry 4.0, particularly in Malaysia. Currently, Malaysia is behind other ASEAN countries like Indonesia and Singapore as the highest growth country in digital economy. The proposed framework is hoped to assist the industries' management in planning for the adoption of technology, in establishing SMS or assessing the need in existing ones. Indirectly, more industry will gain the benefits as a support for their initiatives to transform into Industry 4.0.

An Improved Software Project Monitoring Task Model of Agile Kanban Method: A Practitioners' Perspective

Mazni Omar, Hamzah Alaidaros and Rohaida Romli

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This paper aims to discuss the initial result of the proposed model for improving software project monitoring task of Agile Kanban method (i-KAM).. To achieve this aim, expert review method was used to ensure that suitable components and associated criteria have been included in i-KAM. In this study, six domain experts (practitioners) have been identified based on predefined characteristics and participated in verifying i-KAM based on five dimensions. These dimensions are understandability, relevance, feasibility, organization, and comprehensiveness. Data and feedback have been analyzed using descriptive analysis

and content analysis, whereby it has focused on describing the experts' opinion and the frequency of certain measures. Findings revealed that this study has fulfilled its objective and has acquired constructive suggestions from the practitioners' perspective. Future work will continue to enhance i-KAM according to the recommendations and suggestions from the experts. Approaches such as focus group and case study will be adopted in order to validate the revised i-KAM. Therefore, a prototype would be developed and then implemented in real software development organizations.

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Agile Methods Selection Model: A Grounded Theory Study

Mashal Alqudah and Rozilawati Razali

Agile methods adoption has increased in recent years because of its contribution to the success rate of project development. Nevertheless, the success rate of projects implemented using Agile methods has not completely reached its expected mark, and selecting the appropriate Agile methods is one of the reasons for such lag. Selecting the appropriate Agile methods is a challenging task because there are so many methods to select from. In addition, a lot of organizations consider the selection of Agile methods as a mammoth task. Therefore, to assist Agile team members, this study aimed to investigate how the appropriate Agile methods can be determined for different projects. Based on a Grounded Theory study, 23 Agile experts drawn from 19 teams across thirteen countries were interviewed. Hence, this study employed the Ground Theory of selecting Agile methods. Sixteen factors, grouped into five categories, have been found to affect the selection of twenty Agile methods. The nature of project (size, maturity, criticality and disposability), development team skills (communication skills, domain knowledge, team technical skills and maturity), project constraints (cost/value/ROI, cost of change, time, scope and requirements volatility), customer involvement (collaboration, commitment and domain knowledge) and organizational culture (type of organizational culture) are the key factors that should guide Agile team members in the selection of an appropriate Agile methods based on the value these factors have for different organizations and/or different projects.

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Functional Size Measurement Tool-based Approach for Mobile Game

Nur Ida Aniza Rusli and Nur Atiqah Sia Abdullah

Nowadays, software effort estimation plays an important role in software project management due to its extensive use in industry to monitor progress and performance, determine overall productivity and assist in project planning. After the success of methods such as IFPUG Function Point Analysis and COSMIC Full Function Points, several other extension methods have been introduced to be adopted in software projects. Despite the efficiency in measuring the software cost, software effort estimation, unfortunately, is facing several issues; it requires some knowledge, effort and a significant amount of time to conduct the measurement, thus slightly ruining the advantages of this approach. This paper demonstrates a functional size measurement tool that utilizes the concept of IFPUG Function Point Analysis directly to UML model. The proposed tool can be effective to improve estimation accuracy for mobile game application development.

Evaluation Quality Properties of Software Requirement Specification

Elly Stephen and Edwin Mit

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This paper aims to evaluate the quality properties of software requirement specification (SRS). There are four quality properties to be assessed which are completeness, correctness, preciseness and consistency. The measurement for each quality properties has been proposed in the previous study. The process involved the SRS in .docx format. The system will read through the document provided, do calculation and came out with the result in form of similarity percentage. The percentage of similarity is determine based on comparison with IEEE 830 document. The percentage of result of each quality properties reflect the quality of the software requirement specification.

Efficient Enumeration of Algebraic Structures Using Multicore Systems

Majid Khan, Nazeeruddin Mohammad, Abul Bashar and Shahabuddin Muhammad

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Enumeration of algebraic structures is an important area of study in abstract algebra with several real-world applications. Enumerating algebraic structures of higher order is a computationally intensive task. One of the main time consuming aspect of enumeration is to determine isomorphism classes. In this paper we use a constraint solver to enumerate a class of algebraic structures (IP loop) of given order. These enumerated structures are modeled as color-graphs, which are then checked for isomorphism by using a well-known graph isomorphism checking tool (Nauty). We propose a parallel processing based approach to distribute the color-graphs between multiple instances of Nauty in a multi-core system and then combine the partial results to compute the relevant isomorphism classes. We observed a speedup of around 15x on a 36-core machine for order 13 IP loops. In general, we show that our data parallelism approach scales almost linearly up to a small degree of parallelism and then it scales in a sub-linear manner until it reaches an optimal point. We have used this approach to make a significant contribution in abstract algebra by enumerating the previously unsolved exponent-3 IP loops of order 15.

Pairing-Based Approach to Support Understanding of Object-Oriented Concepts and Programming

Shahida Sulaiman

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Blended learning comprises various learning modes with the support of digital resources. It has been a key element in 21st century teaching and learning environment. In software engineering field, Pair Programming (PP) is one of the techniques in Xtreme Programming principles in Agile software development methodology. Although PP is well-known among practitioners, studies have shown that PP can also support computer science or software engineering students at higher learning institutions to understand the concepts in programming mainly object-oriented concepts. Inspired by PP, this study proposes that pairing-based pedagogy or “pairgogy” in blended learning could also increase students’ confidence and interest in completing theoretical in-class exercises not limited to programming tasks with the support of an e-learning system. The findings reflect that both PP and “pairgogy” complement one another as a pairing-based approach in blended learning to support understanding of object-oriented concepts and programming.

79**Comparing the Accuracy of Hierarchical Agglomerative and K-means Clustering on Mobile Augmented Reality Usability Metrics**

Kok Cheng Lim, Ali Selamat, Mohd Hazli Mohamed Zabil, Rose Alinda Alias, Fatimah Puteh, Farhan Mohamed, Ondrej Krejcar and Md Hafiz Selamat

This article presents the experimental work of comparing the performances of two machine learning approaches, namely Hierarchical Agglomerative Clustering and K-means Clustering on Mobile Augmented Reality Usability datasets. The datasets comprises of 2 separate categories of data, namely performance and self-reported, which are completely different in nature, techniques and affiliated biases. This research will first present the background and related literature before presenting initial findings of identified problems and objectives. This paper will the present in detail the proposed methodology before presenting the evidences and discussion of comparing this two widely used machine learning approach on usability data.

80**Algorithm for An Automated Clarias gariepinus Fecundity Eggs Estimation Technique Using Cubic Spline Interpolation and Gaussian Quadrature**

Abdul Aziz K Abdul Hamid, Norfazlina Amirudin, Gobithaasan Rudrusamy, Masduki Mohammad Morni and Sumazly Sulaiman

Fecundity is important in the field of population ecology where the number of eggs is measured to get the actual reproductive rate of an organism. The estimation of fecundity is essential for an accurate study of biology and population dynamics of fish species. This estimation can be developed using gravimetric method (weight method) to calculate the number of eggs. However, this method still requires experienced technicians and much time and effort to manually compute the number of eggs. Hence, this research addresses the problem by means of constructing a computer vision algorithm. This paper introduced the automatic fecundity estimation method which applied simple mathematic theories and image processing algorithm to estimate the fecundity of African catfish (*Clarias gariepinus*). From the image of the fish, the fish's eye will be detected using modified Haar Cascade Classifier Algorithm and appointed axis line where the eye become the origin point. Next, we identify the region of interest which reflects the fish's fecundity to obtain the pixels corresponding to the silhouette of the region as coordinates in euclidean space which are then represented with a function using cubic interpolation function. Using this function, we compute the region of interest using numerical integral approach, e.g., Gaussian Quadrature. From the result, we will compared with the ground truth to get the estimation the number of eggs.

Domain Specific Modeling Language for Strategy Educational Games and Transfer Learning Theory

Nur Aisyah Nurhadi, Lukman Ab Rahim and Ana Syafiqah Zahari

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In designing educational games, both expertise from technical (game developer) and non-technical (educator) people are needed. Their ideas and knowledge must be combined in order to develop a successful educational game. To present the ideas, a Domain Specific Modeling Language (DSML) is required to transform it into graphical method which helps technical and non-technical people to involve together and bring in their knowledge. This paper is presenting the selected DSML – Serious Educational Games Structure and Logic Modeling Language (GLiSMo) to simplify the designing process of strategy games genre. Yet, GLiSMo only cover certain games components and does not consist any learning theories which the important part in designing educational games. Through this study, the extended version of GLiSMo with additional components of strategy games and transfer learning theory are included. The extended GLiSMO were evaluated using Framework for Qualitative Assessment of DSLs (FQAD) characteristics; completeness and appropriateness. The language were demonstrated using Civilization V strategy game.

Sustainable Software Engineering: A Perspective of Individual Sustainability Challenges

Sumaira Nazir, Suriayati Chuprat and Nargis Fatima

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Sustainable software engineering is a mean of developing sustainable software with sustainable software engineering process activities while balancing its various dimensions for instance economic, environmental, social, technical and individual. It is conveyed that the economic, technical, environmental and social dimensions are explored to satisfactory degree however the individual dimension of sustainable software engineering which is concerned with well being of software engineers is not explored to satisfactory degree with respect to its understanding and challenges. Therefore the aim of the study is to highlight and prioritize the challenges regarding individual sustainability dimension. The study also provides the mitigation strategies for the top five individual sustainability challenges. The systematic literature review has been performed to report the challenges and mitigation strategies. The study finding shows that lack of domain knowledge, lack of methodologies and tool support, lack of education, varying and unidentified situations and lack of sustainable software engineering practices are top most challenges regarding individual sustainability. These challenges need an urgent attention to achieve the goal of sustainable software engineering.

Sustainable Software Engineering: A Perspective of Individual Sustainability Challenges

Sumaira Nazir, Suriayati Chuprat and Nargis Fatima

Sustainable software engineering is a mean of developing sustainable software with sustainable software engineering process activities while balancing its various dimensions for instance economic, environmental, social, technical and individual. It is conveyed that the economic, technical, environmental and social dimensions are explored to satisfactory degree however the individual dimension of sustainable software engineering which is concerned with well being of software engineers is not explored to satisfactory degree with respect to its understanding and challenges. Therefore the aim of the study is to highlight and prioritize the challenges regarding individual sustainability dimension. The study also provides the mitigation strategies for the top five individual sustainability challenges. The systematic literature review has been performed to report the challenges and mitigation strategies. The study finding shows that lack of domain knowledge, lack of methodologies and tool support, lack of education, varying and unidentified situations and lack of sustainable software engineering practices are top most challenges regarding individual sustainability. These challenges need an urgent attention to achieve the goal of sustainable software engineering.

An Experiment of Different Prioritization Algorithms on Test Case Prioritization Technique for Software Product Lines

Muhammad Sahak, Dayang N. A. Jawawi and Shahliza Abd Halim

The Software Product Line Engineering (SPLE) is used to manage variabilities and commonality of the business adopters to satisfy the goals of market segment. Time and space complexity being a main challenge for SPL adopters to overcome. Combinatorial Interaction Testing (CIT) is suggested to reduce the size of test suites and known as the most promising approach to overcome the issue. However, there are still issue such as combinatorial explosion from the features drained the testing effort required. Therefore, Test Case Prioritization is needed to select only a few of test cases to detect a high number of faults. Among the promising approach is a Similarity-based prioritization consists of similarity measure and prioritization algorithm. Similarity based test case prioritization reorder the test case through calculation of distance between test case using similarity measures and undergoes ranking process using prioritization algorithm. This paper provides a comparison of prioritization algorithms to investigate the capability and the most suitable similarity measure to be used for our proposed Enhanced Jaro-Winkler through experimentation. Local Maximum, Global Maximum and All-yes Config have been chosen as prioritization algorithms in our study to be compared. The result shows JaroWinkler as the best similarity measure with 84.17 average APFD scores in eight feature models. The purpose of the discussion is to offer insight on the prioritization algorithms in SPL context and likely room for improvement through experimentation and comparison studies.

Team Formation for Agile Software Development: A Review
Dzulaiha Aryanee Putri Zainal, Rozilawati Razali and Zulkefli Mansor

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Rapid and unpredictable technology advancements cause a rise in demand for software products that can be delivered faster, adapt to volatile changes and save cost. Over the years, Agile Software Development (ASD) becomes more suitable as the software process that can cater for those demands. The agility lies in the capability of ASD methods to adapt to volatile and rapid changes whilst maintaining the quality desired. With this Agile nature, it is apparent that the team that develops the software product need to have special features as well. The team should also be formed correctly to gain effectiveness, well performance and ultimately project success. Ineffective teams can cause among others, conflict, inadequate skillset, unbalanced role assignment, lack of teamwork and non-competent team members. However by far, the characteristics that need to be considered in forming effective teams are yet to be formalized. Thus, this study aims to identify the necessary characteristics in composing an effective team that is well balanced and are able to create coherent teamwork. The study involves a qualitative literature review which includes past studies about team formation specifically in software development domain. The data were collected from online journal databases and analysed using content analysis. From the analysis, six characteristics together with their attributes were identified as vital in team formation. Another two characteristics were also identified as influencing the six team formation characteristics. These findings will need further empirical rigor before they can become a complete Agile Software Development team composition model. This model is believed to assist Agile practitioners in forming effective teams for their development projects.

Web Content Quality Model for Massive Open Online Course (MOOC)

Wan Nurhayati Wan Ab. Rahman and Ahmad Wiraputra Selamat

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MOOC is an online platform that allows learners to access variety of course from institutions around the world to meet credential requirements or simply to expand knowledge informally though lifelong learning. MOOC have gained a lot of attention in recent years as a new technology-enhanced learning (TEL) approach in higher education. However, the major weakness of MOOC is the high attrition rate among the learners as the average completion rate is below 13%. Previous research pointed on the weakness of web content in MOOC platform as a main factor of MOOC student attrition like low usability, lack of diversity features, poor structure and poor design. As this paper is written, there are no clear model for the web content quality in MOOC. In fact, the quality factor for web content as general is never explained in the context of MOOC, although the study proves that MOOC needs a special definition for all these factors. This research is proposing a quality model for MOOC web content as reference to content providers, instructors and system designers to develop the content with the right quality features that encompass various dimensions. In order to achieve the goal, we will identify and describe the factors supporting the quality of content from previous literatures. Then we will classify the quality factors into related category and develop a robust quality model for MOOC content as a reference for the content designer / developer. The study on the web content quality of the MOOC from the perspective of the web engineering is first to be implemented. This research will make MOOC's learning more optimistic and

beneficial to the students through the utilization of high quality content. Besides, the proposed model will contribute to the body of knowledge related to the identification of the factors affecting MOOC content quality.

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An Improved Test Case Generation Approach for Mobile Applications Considering Context and GUI Events

Asmau Usman, Noraini Ibrahim and Ibrahim Anka Salihu

The increase of mobile devices with rich innovative features has become an enabler for developing mobile applications (mobile apps) that offer users an advance and extremely-localized context-aware content. Nowadays mobile apps are developed to address more critical areas of people's daily computing needs, which bring concern on the quality of the application. In order to build a high quality and more reliable applications, there is a need for effective testing techniques to test the apps. Most of the recent testing technique focuses on GUI events only which make it difficult to identify other defects in the changes that can be inclined by the context in which an application runs. This study proposes an approach for testing mobile apps considering the two sets of events: GUI events which were identified through static analysis of bytecode and context events obtained from the analysis of app's permission. An empirical experiment on real-world open source mobile apps has been performed to evaluate the proposed approach. Results from the experimental evaluation indicated that the approach is effective in identifying context events and had 61%-91% coverage across the seven selected applications. To evaluate the fault detection capability of this approach, mutation testing was performed by introducing mutants to the applications. Results from the mutation analysis show that 100% of the mutants were killed. This indicates that the proposed approach has the capability to detect faults in mobile apps.

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Design and Implementation of Instructional Support to Enhance Programming Problem-Solving Skills: Applying Cognitive Load Theory and Worked-example

Syhanim Mohd Salleh, Zarina Shukur and Hairulliza Mohamad Judi

Learning computer programming is a challenging task for beginners as there are various concepts to master at and a field of syntax to be familiar with. The availability of effective instructional design and student support strategies may help beginners with best possible learning surroundings that they need. Scaffolding may help students with materials that support their interaction with the lesson and enhance engagement in the activities that would otherwise be outside their capacity. This research proposes a design of worked-example and scaffolding in programming lesson and demonstrates the scaffolding implementation in delivering programming topic on stack. This research employs cognitive load theory in the instructional design to provide learning support by presenting task example programming problem solutions and reducing cognitive burden using three useful components: question, solution and scaffolding execution. The demonstration may provide instructors with specific and complete references to develop an appropriate task statement systematically in an efficient programming learning.

Arabic Sign Language (ArSL) Recognition System using Convolutional Neural Network (CNN)

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Roaa Alkhalaf, Rawan Alkhalaf, Ghazanfar Latif, Nazeeruddin Mohammad, Jaafar Alghazo and Majid Ali Khan

People with disabilities have long been ignored. With the advancement of the recent technologies, so many tools and software are designed for the disabled people to improve their lives. In this research, Arabic Sign Language (ArSL) recognition system is developed using the proposed architecture of the Convolutional Neural Network (CNN). The aim is to help people with disabling hearing problems to communicate with normal people. The proposed system recognizes the Arabic alphabets signs based on the real-time user input. The CNN architectures were trained and tested using a database of more than 50000 Arabic sign images collected from random participants of different age groups. Several experiments are performed with changing CNN architectural design parameters in order to get the best recognition rates. The experimental results show that with the proposed CNN architecture achieves a very good accuracy of 97.6%, which is higher than the accuracy achieved by similar other studies.

Empirical Exploration of Success Factors and its Solutions in the context of Green IT-Outsourcing

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Siffat Ullah Khan, Rahmat Ullah Khan and Rafiq Ahmad Khan

From the last decade green computing has started to expand rapidly and getting reputation in both academia and industry. What's more the far reaching comprehension to natural concerns, such consideration too stalks from financial needs, while both power costs and electrical necessities of IT generation around the globe demonstrate an always rising propensity. Green computing is the examination and routine with regards to proficiently utilizing PC assets. At first, we directed and distributed precise writing audit for the distinguishing proof of success factors in Green IT-outsourcing from vendors' viewpoints. In this paper, we show findings of the empirical study conducted in the software outsourcing industry. We have performed questionnaire survey and have utilized both online resources and face-to-face meetings with some of the participants of the survey. At the end, we got responses from 47 specialists from various Green IT-outsourcing vendor organizations. In the questionnaire survey, we have gathered the view points of the experts on a seven point Likert scale to decide the apparent outcome of every success factor. The survey identified 9 success factors for vendors. Out of these, seven have been marked as critical success factors (CSFs), for example, 'Energy efficiency', 'Development and use of environment-friendly software', 'Deployment of virtualization strategies with respect to hardware, software and processes'. We have identified a total of 29 practices for the identified 7 critical success factors.

Heuristic Algorithm for Multi-Location Lecture Timetabling*San Nah Sze, Huiggy Kuan, Kang Leng Chiew and Wei King Tiong*

This paper studies a real faculty timetabling problem with multi-location consideration at Universiti Malaysia Sarawak. (UNIMAS). To fulfill the market demand, UNIMAS offers master programmes via coursework to working adults. Currently, the master programmes via coursework also being offered at a few learning centers beside its main campus at Kota Samarahan, Sarawak. Due to that, lecture timetabling has become very challenging, while considering multi-location constraint, unavailability dates of lecturers, different lecture-sessions, limited timeslots, evenly distributed timetable and so on. In this paper, a two-stage heuristic algorithm is proposed to solve this multi-location lecture timetabling problem. First, it groups all the courses which can be conducted on the same timeslot or weekend. Then, timeslot allocation is assigned to the prior groups. The proposed algorithm is then compared with the manually designed solution and simulated datasets. The result shows that the proposed is not only fast in generating a clash-free timetable, but also produce an evenly distributed lecture timetabling.

Modelling Emotion Expression Quiz Master for eLearning through Agent Oriented Approach*Syazwanie Filzah binti Zulkifli, Cheah Wai Shiang, Nurfaiza binti Jali and Muhammad Asyraf bin Khairuddin*

eLearning is introduced to promote self-learning anytime and anyway. To date, various components have been added into an eLearning platform to produce an interactive and engagement eLearning platform. Among an interest component is embedded emotion into eLearning system. While emotion is paying much attention nowadays, there is lacking systematic way to model the emotion based elearning. Without the systematic approach, it is hard to debug, design and develop an emotion based elearning system. This paper introduces emotion goal through agent-oriented approach. In addition, we demonstrate how to design an emotion-based quiz master as an embedded emotion element for eLearning system through the proposed modelling approach. The contribution of this paper is to introduce agent oriented modelling to systematic model an emotion based solution for an elearning system. With the emotion model, it can serve as a guide to design, redesign, discuss the emotion elements among the software development team. This is important for better debugging and project management especially for emotion led application.

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